The "Table Cloth" on Table Mountain.

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The Trans-Polar Flight of Captain Sir G. H. Wilkins on 16th April, 1928

It has long been recognised both in this country and abroad that when flying can take place regularly across the Polar regions many of the long-distance flights envisaged would be very much shortened. To mention but one of these flights, from the British Isles to Japan, only 6,000 miles would be covered if Polar regions were traversed, while by the ordinary shipping routes or along the routes already followed by aircraft the distance approximates to 11,000 miles. However, for the safe and regular operation of such flights, whether by airship or aeroplane, it is essential to have detailed information of the average weather conditions along the selected route, while for any individual flight the existing pressure distribution and the changes to be expected during the flight are required. This involves a network of meteorological reporting stations and it is here that such flights encounter a great difficulty. At the present time little information on which to base average weather conditions is available for any points north of latitude 75°. There is only Spitsbergen in the European Section reporting regularly, although Bear Island and two Siberian Stations border on this limit. Northwards there is solely the information obtained by various Arctic explorers, and this refers to different parts of the Polar basin and is scattered irregularly over a large number of years.

It became thus essential to find whether there are possible sites in these Polar regions where meteorological stations can

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be established and particularly if there are islands in the unexplored regions north of Alaska and Eastern Siberia.

With this object in view Captain Sir G. H. Wilkins, M.C., and Lieutenant C. B. Eielson undertook a detailed survey of this section of the Polar basin using Point Barrow, the most northerly point in Alaska as their base of operations. These operations extended over the years 1926-7-8, but by using aircraft it was not necessary to spend more than a short portion of the year at this base. Another advantage possessed by aircraft was the great saving of time in exploring a large area where journeys over the ice on foot are often difficult, slow and laborious. In 1926 little information was gained, but in the following year a flight 600 miles north-west of Point Barrow was undertaken, and a landing made. The sounding indicated a depth of one mile for the sea and thus the absence of any islands in this region. This year it was intended to fly 600 miles north-east from Point Barrow and if no land was observed to continue the flight around the Polar basin to Spitsbergen.

In both the latter years the actual time when the flight commenced was regulated by the existing weather conditions, and all assistance possible was obtained by employing following winds.

An investigation of the changes in the pressure distribution over the northern parts of the northern hemisphere during and just prior to the flight on 16th April has been carried out by M. Rodewald and is published in *Annalen der Hydrographie und Maritimen Meteorologie*, pp. 192-195, Vol. VI, 1928. A weather chart covering these regions for 13h. G.M.T. on 16th April accompanies the paper. The essential features of the pressure distribution are large anticyclones, one extending from northern Alaska to the Liakhof Islands, another over northern Greenland and a third extending northwards from northern Russia. There were relatively shallow depressions over Baffin Island and Siberia and an intense depression centred over Spitsbergen. During the first part of the flight where the central regions of the Alaskan anticyclone were crossed the winds were light, the sky cloudless and the visibility good. The northerly current on the eastern side of this anticyclone became gradually shallower as the flight progressed and clouds of the St. or St.-Cu. type were found at a height of 3,000 feet, these clouds being formed at the upper boundary of the surface layer of cold air. Over this first third of the flight frequent extensive snowdrifts were observed mainly in a west-east direction, and Captain Wilkins concludes that in general the prevailing winter wind direction in these regions is west-east.

As Grant Land was approached the amount of cloud again increased and extended more than 6,000 feet upwards. This was very probably formed in the warm air current moving on

the eastern side of the Baffin Island depression. The northward movement of this air was shown by observations from west Greenland. The mountains of Grant Land were seen projecting through the clouds, while a snowstorm was encountered over the Lincoln Sea. As the flight continued towards Spitsbergen the aeroplane was assisted more and more by the north-westerly wind blowing between north Greenland and Spitsbergen, but weather commenced to deteriorate. The A-St. cloud associated with the Spitsbergen depression was soon met, the temperature fell to —54° F., and at about 250-300 miles from Spitsbergen immense Cu.-Nb. clouds were encountered extending about 6,500 feet and with an unbroken lower surface. The winds became more and more stormy with great turbulence, while the base of the cloud reached gradually lower levels. Almost continuous snow was encountered, but a landing was effected on the western side of Spitsbergen.

During the whole of the flight no land was encountered over the Polar basin, and from that point of view the results of the exploration were negative. Captain Wilkins concludes that such meteorological stations as will need to be established in these regions must thus be on the drifting ice and not on land.

R. S. READ.

Transport of Sea-Spray Inland by Gales

The fact that sea spray may be carried by gales for long distances inland has been recognised for many years, although the occasion mentioned in the January number of the *Meteorological Magazine* may be the first on which the presence of sea salt has been noted for its effect on electric transmission lines.

In *British Rainfall* for 1864-65 notes showed that the question was in mind; mention was made of the utility as well as interest of the detection of the amount of sea spray "10, 20, 30 or perhaps more miles inland." It had been observed that "at Cape Wrath the gauge is 355 feet above the sea, yet, when a heavy south-west gale is blowing the yard in which the gauge stands is reported to be flooded with sea spray lifted up by the wind."

In *British Rainfall* 1866 it is mentioned that "we have seen windows three miles inland frosted like ground glass, and the detection of stray crystals 20 and 30 miles from the sea is frequent"; and in a footnote it is mentioned that after the great storm of January, 1839, salt was seen deposited on the leaves of the trees at two places near Huddersfield "about 80 miles from Scarborough and 60 miles from Liverpool (the nearest ports of the opposite coasts)." In the same article it is mentioned that arrangements had been made by Mr. Symons for supplying at a

cost of £1, sets of apparatus and chemicals (silver nitrate and chromate solutions) for determination of the amount of salt in solution.

Several occasions are noted in *Symons's Meteorological Magazine*.

In 1869 salt equivalent to 11·2 grains per gallon of rain was found at Chepstow in rain which had fallen during squalls from W. and NW. Correspondence followed this report regarding the probable accuracy of the measurement; incidentally one of the writers who evaporated the whole of a year's collection from his raingauge, " 932 cube inches down to about a cubic inch " seems to have been a pioneer in atmospheric pollution measurement. After a violent gale which swept the south of England in April, 1882, letters were published giving observations of salt on foliage at Tonbridge, 30 miles inland, and at Kew Observatory, over 50 miles from the sea in the direction of south-south-east from which the gale had blown. It was stated by Mr. G. M. Whipple, then Superintendent of the Observatory, that the greatest hourly run of the wind during the gale was 50 miles but several gusts of 70 to 80 m.p.h. had been timed.

References were also published to occasions when " in one great gale all the windows in Leeds which faced west were covered with a thin film of sea salt " (the sea is 54 miles to the west, over the Pennines, about 1,500 feet high); and when there had been made measurements of 5 to 7 grains of salt per gallon, carried by autumnal gales to Cirencester, where " if no rain followed for a few days after the gale, the salt sparkled on the trees even at a distance of 35 miles from the Bristol Channel."

It was stated that the phenomenon was first noted by Dalton at the beginning of the century.

In 1889 references were made to salt hail, and to salt moisture carried to a distance of about 25 miles from the Firth of Clyde.

In 1890 a salt film was observed on windows 30 miles from the Ayrshire coast. In this case the wind was from about south, and the salt may have come from Luce Bay (Solway Firth) more than twice that distance. " In either case it had to cross the range of hills dividing Ayrshire from Clydesdale, where it would be projected upwards to a considerable altitude before it found a final resting at Cambuslang, 150 feet above the sea level."

After the gale of 22nd December, 1894, reports of salt being detected inland were received from Settle (24), Sowerby Bridge (40), Bolton Abbey (42), Harrogate (50), East Ardsley, Wakefield (57), Bramhope (60), and Burton House, Masham (65 miles from the west coast). From Birmingham, 55 miles from the Bristol Channel and nearly 100 miles from Cardigan Bay, came two reports of objects being covered with salt. Near Garstang, about 10 miles inland, on the following day, " brine of nearly twice the usual specific gravity of sea water " was found dripping from trees.

There appears to be no more mention of the subject until November, 1911, when at Ilkley, 50 miles inland, after a severe westerly gale lasting more than 24 hours, a salt incrustation was observed on windows. Analysis of the water in the rain-gauge showed salt equivalent to 13 lbs. to the acre, or $3\frac{3}{4}$ tons to the square mile.

Presumably the conditions under which the salt can be carried long distances inland and deposited in a way suitable for attracting attention are rather specialised, but in view of the contemplated large increase of power transmission lines in this country, opportunities for occurrences such as those of 28th October ought to be more frequent in future.

S. T. A. MIRRLEES.

OFFICIAL NOTICE

Course of Training for Observers

It is proposed to hold a course of training for observers at climatological stations on Monday, Tuesday and Wednesday, 24th, 25th and 26th September, 1928, at Kew Observatory, Richmond.

Subject to limitations of space at the Observatory, the course will be open to all climatological observers or deputy observers in connection with the Meteorological Office. There will be no fee.

Admission to the course will be by ticket, which may be obtained on application to the Director, Meteorological Office (M.O.7), Air Ministry, Kingsway, London, W.C.2, from whom further information regarding the course may also be obtained.

Institution of Water Engineers

The thirty-third summer meeting of the Institution of Water Engineers was held in Torquay on the 12th to 15th June. The general meetings were held in the Reception Room at the Town Hall, where an official welcome was given by the Mayor of Torquay and Mr. S. C. Chapman, C.E., Engineer of the Torquay Waterworks, presented his presidential address. Papers on "The Torquay Corporation Waterworks" by R. V. Toms, on "Average and Extreme Seasonal Rainfall" by J. Glasspoole, and on "The Water Supply of Lourenço Marques, Portuguese East Africa" by R. H. Fox, were also read. A lecture was subsequently given on "The Geological Structure of Dartmoor" by R. G. Handsford Worth. Visits were paid to H.M. Dockyard at Devonport, to the Burrator Reservoir

(Plymouth Corporation), Venford Reservoir (Paignton U.D.C.) and to Tottiford Reservoir (Torquay Corporation). A summary of Dr. Glasspoole's paper is given below.

Average and Extreme Seasonal Rainfall over the British Isles

The engineer engaged in the supply of water for domestic purposes naturally considers the year divided into two parts, viz., a winter half-year, October to March, in which evaporation is small, and a summer half-year, April to September, in which the reserves of water are usually drawn upon. The meteorologist, unfortunately, usually adopts other subdivisions of the calendar year so that relatively few seasonal rainfall statistics have been published. An endeavour to meet that deficiency has been made in this paper.

The average falls of the winter and summer half-years are considered in the paper separately, and expressed as a percentage of that for the whole year. There are only three areas where the summer rainfall is the greater, viz., in the Fen District, round the mouth of the Tees and near Edinburgh. In these relatively dry areas the average summer rainfall slightly exceeds that of the winter. Conversely, the usually wet stations of the west receive much more rain in the winter than in the summer. On Dartmoor 65 per cent. of the average annual amount falls in the winter six months. In such regions complete use of the available water can only be made by extensive storage of the winter rains.

The fall in each half of the seasonal winter and summer, *i.e.*, October-December, January-March, April-June and July-September, is also defined by means of maps for all parts of the British Isles. This emphasises the wide range in the Western Highlands of Scotland, from only 15 per cent. in the three months April to June to over 30 per cent. of the annual amount in both October to December and January to March. The maintenance of the water supply in early summer is therefore dependent upon the adequate storage of the winter rains.

It is also shown that while in mountainous areas there may be considerable diversity from place to place in the annual rainfall, there is only a slight variation in the proportion falling in the different seasons. This is important to a water engineer since quite frequently, while there are long rainfall records in the drier valleys, records in the mountainous parts of the catchment area are quite short. Having determined the average annual rainfall of any given catchment area, the proportion falling in the seasons can be computed fairly accurately by using stations in the adjacent valleys. It is demonstrated that the high proportion of rain in the winter is primarily a feature of stations in the west of the country, so that Torquay, like other places in the west, offers certain advantages over the

much advertised " dry east coast " in that rain falls mainly in winter. Similarly, stations in the west also score in that there is a slight preponderance of rain at night over that during the day—the Midlands and east coasts having a greater tendency to thunderstorms in the summer afternoon.

Another interesting fact brought out by the paper is that over the British Isles generally a definite wet period set in about 1906, and while initially the excesses were contributed more especially by wet winters, of recent years the summers have been unusually wet.

Extreme values in 60 years' records are given for the winters, summers and seasonal years separately for certain representative stations. Attention is directed more particularly to the smallest falls on record as proving the severest tax on the capacity of water-supply schemes. Over the British Isles as a whole wet years have so predominated recently that in the last 22 years a rainfall appropriate to 23 years has occurred. So great an abundance of rain obviously cannot be relied upon in the future. Moreover, it is reasonable to expect that the present run of wet years will break down and the accumulated excess be wiped off in due course. This renders a consideration of the driest periods on record of some importance, especially in the case of those water-supply schemes which have only just been able to cope with increasing demands during the recent years of plenty.

Correspondence

To the Editor, *The Meteorological Magazine*

Unusual Thunderstorm Phenomena

With regard to the " vit " or " click " sound* accompanying lightning or preceding the thunder by a perceptible fraction of a second, the sound is familiar to any one living within the tropics. I have noticed it eight times in twelve years. I am certain that the interval does occur, or appears to occur and I have tried to get at the reason with others who have also noticed it.

The instance I gave you of thunder occurring 204 seconds after the flash is undoubtedly correct. The spacing between the individual flashes and corresponding thunder varied only 4 or 5 seconds over half a dozen flashes or more. They only occurred about every five minutes. There were no weaker flashes from any other point of the sky between them. There are no railways or towns situated in that direction, neither are there heavy guns in the neighbourhood to produce the sound. The flashes were short and sharp, and, considering the distance of the storm, extremely brilliant. The sky was clear nearly to the horizon.

Meteorological Magazine, 63 (1928), p. 113.

A Survey Department friend, who has spent long periods on the tops of mountains, assures me that he has timed thunder over 300 seconds and is equally as positive as I am about it.

There is one more point I should like to mention to you, if I am not boring you, and that is, the length of lightning flashes. Though the storms here are generally not half so severe as in other parts of the world, we frequently get good opportunities for observing flashes unobstructed in their course. There are two extremes. The first appears in "pillar" cumulus clouds which form in hot weather. Before the cloud extends and a general storm occurs, these flashes are very short and one can often detect reports of thunder not more than two seconds in length. The second results from storms which have formed among the mountains or on the farther side of them, the peaks of the clouds having caught upper currents and having drifted back in a contrary direction to the surface current. The flashes start from, say, overhead, perhaps three miles above, follow the course of the cloud and earth twelve miles away under the base of the storm. The thunder begins with an ordinary rattle, proceeds more or less drowsily until it takes its final plunge to earth with a tremendous booming about a minute after the flash has occurred.

The longest flash I think I ever saw happened one evening last year after an afternoon of many local thunderstorms. The storms were spent and the flash was the last of many, a considerable interval having intervened between it and the previous one. It started at a great height nearly overhead. One end I traced afterwards, went to earth at Roubibon about twelve miles away, the other went away at right angles for about the same distance. The thunder started from the nearest point, overhead, and rumbled away in each direction for about a minute, ending in each case with the usual distant roar marking the direction of the point of contact with the earth.

R. S. BRETON.

The Siam Commercial Bank, Ltd., Tung Song, S. Siam. 6th June, 1928.

I found Mr. Breton's remarks about the "click" accompanying lightning unusually interesting, as I have heard the phenomenon on numerous occasions, but have never before seen it mentioned in meteorological literature. The sound is practically simultaneous with the flash; there is a slight but scarcely perceptible lag.

An explanation that seems to me to satisfy the conditions is that the sharp sound is due to a relatively small induced discharge occurring in the vicinity of the observer, perhaps 3 or 4 yards away, the sound being due to sparking in some imperfect conductor. I have in mind small gaps in metal pipes and

the like: this agrees with the mental impression of the sound as I remember it now.

R. M. POULTER.

28, *Pinner Park Avenue, Headstone Lane, Middlesex.* 21*st June*, 1928.

I have read with great interest Mr. R. R. Breton's account of a "vit" or "click" preceding thunder from a very close discharge of lightning.

I have on two occasions noticed it—in the storm of 9th July, 1923 (I think the date is right) lightning struck the house next but one to this. I was watching the storm from an open window and heard three distinct "vits" very close together and presumably simultaneous with three successive discharges. All these were heard before the first deafening crackle of thunder.

The other occasion was a very long time ago when a tree was struck in Broomfield Park, Palmers Green, in North London. At the time I was about 300 yards from the tree, and the sound resembled, I remember, that of a branch being cracked off.

The phenomenon is not altogether new. I have heard it discussed from time to time and have also heard the explanation given that it is entirely subjective, being produced by the induced charge in the subject's head escaping to the earth simultaneously with the flash. The momentary current stimulates the auditory nerve. It would doubtless stimulate the optic nerve also, but the simultaneous brilliance of the real flash prevents this being seen.

If the phenomenon is not subjective it cannot be a true sound because it must be carried by an ether wave, otherwise it could not precede the thunder and be simultaneous with the lightning.

RONALD L. BEST.

73, *Bexley Road, Erith, Kent.* 22*nd June*, 1928.

Sea-spray in the Rain-gauge*

A striking example of the effect of spray at an exposed place on the coast during the gale which swept the country on the night of 10th-11th February of this year was brought to light during a recent inspection of the telegraphic reporting station at St. Ann's Head. The gauge at this station is situated on a bleak headland about 150 feet above sea level, and just over 100 yards from cliffs to the west which slope down abruptly to an inlet known as "Cobbler's Hole." The observer on duty on the night in question says that it appeared to be raining hard whilst he was on watch at the signal station, which is close to the rain-gauge, but his relief, who walked across the headland about midnight reported that the night was fine and clear on the eastern side of the headland. In the morning it was found that

* *See page* 131.

there was much brine in the gauge and the observer is almost certain that of the 8.8 mm. " rain " measured at 7h. on 11th, not more than a millimetre or so was true rain. There is little doubt but that the very high wind (WNW, force 9 at 1h.), in sweeping up and over the headland carried with it large quantities of sea water and deposited it over the area in which the rain-gauge is situated. The *Daily Weather Report* shows that the following amounts were recorded:

	Day 10*th*.	*Night* 10*th*-11*th*.
	mm.	mm.
St. Ann's Head	3	9
Scilly	2	1
Aberystwyth	5	0.3
Ilfracombe	2	0.6

The total fall for 24 hours ending 9h. on the 11th at Haverfordwest, Portfield, about 12½ miles inland, was 4.5 mm.

C. V. OCKENDEN.

R.A.F., Worthy Down, Winchester. 15th May, 1928.

Sea and Road Mirage

I was much interested in reading the articles on this subject in the January and February issues. I have not observed any road mirage in my time and am an octogenarian, but I have seen a sea mirage once only at Tenby although I have visited there on business as a commercial traveller for thirty-five years and looked for more when there and also during my career in England, Ireland, Scotland and Wales. It was about 1882 looking from the Castle Hotel at Tenby that I saw on the horizon what looked like a lighthouse; it did not hold very long but was clear and distinct. The day was fair and the sight I shall never forget.

Reading in the *Wonder Book of Atmosphere* by Edwin J. Hunter, Ph.D., he writes " a report was once spread at Malta (page 250) that a new island had arisen from the sea in the channel at a distance of from four to six miles. The different objects on this island were so clearly visible to the unaided eye, that several ships in the harbour thought of taking possession of the new land in the name of their respective countries. This afterwards proved to be a portion of the coast of Sicily and included Mount Etna.

HENRY A. ROGERS.

31, *Fernbank Road, Redlands, Bristol. 5th April*, 1928.

Road Mirages

In the *Meteorological Magazine* for December, 1927, Mr. Vernon Jones gave an account of his observations of a road mirage.

A similar mirage was under observation during the years 1922 and 1923 on one of the tarred roads inside the aerodrome at

Biggin Hill, Kent. The road itself had a fairly level stretch of about 100 yards, but fell away gradually at either end of this stretch. It was on this higher level portion of the road that the mirage was formed and in appearance resembled a pool of water in which white posts along the side of the road were clearly reflected. The mirage was equally visible from both ends of the road.

The most curious fact about the phenomenon was that it was visible both in winter and summer (although less intense in the former season) under most conditions of wind, weather and temperature. It reached its greatest intensity during hot summer middays, but was still faintly visible as dusk approached. High winds only served to diminish the intensity. Even with a damp road and drizzle falling one was considerably surprised to find that, on approaching what appeared from a distance to be a puddle of water, the puddle vanished.

A series of readings were taken twice daily—morning and afternoon—from July 14th to August 23rd, 1923, with an Assmann psychrometer at heights of 1 inch, 3 inches, 1 foot, 3 feet and 6 feet respectively above the tarred road, and corresponding notes made of the intensity of the mirage, but these failed to give any definite relationship between the intensity of the mirage and the height distribution of temperature and humidity.

W. H. Bigg.

R.A.E., South Farnborough, Hants. 19th May, 1928.

Parhelia observed at Hindhead

The phenomenon described below was observed yesterday evening (23rd June). At 19h. to the west the sky was covered with thin cirrus and there were a few patches of alto-cumulus and some lumpy strato-cumulus. At 19h. 15m. a faint solar halo of 22° became partly visible and some faint iridescence was seen on the alto-cumulus just after. By 19h. 31m. the halo had become almost complete, and much brighter, and the left parhelion was visible. The right parhelion appeared between cloud masses at 19h. 41m. The phenomenon was visible intermittently until sunset, although after 19h. 50m. it was masked by brilliant sunset colours. The last observation of parhelia here was on 25th February, on which day the phenomenon was visible over a wide area. The unsettled weather and the appearance of last night's sky lead me to believe that yesterday's phenomenon was very local.

S. E. Ashmore.

Windwhistle Cottage, Grayshott, Hindhead, Surrey. 24th June.

Solar Halo at Heyford

Mr. Goodyear called my attention to a very fine solar halo (22°) at 13h. 40m. G.M.T. to-day (Tuesday, 8th May, 1928). Not only was the whole of the circular halo visible but also the complete ellipse through the upper and lower arcs of contact. The theodolite was erected as expeditiously as possible, but by 13h. 45m. G.M.T. the ellipse had disappeared, leaving only the circular halo with the arcs of contact. The dimensions of the ellipse with respect to the circle were so impressed on our memories, however, that an estimate of the length of the semi-major axis could be made by means of the theodolite with reasonable accuracy. This was found to be 29° approx. The colouring along the arcs of contact was extraordinarily brilliant, even the violet being visible through the goggles. There can be no doubt that the phenomenon was similar to that shown on Plate IV, *Observers' Handbook, 1926*, except that in this case the ellipse was absolutely complete.

N. H. Smith.

Upper Heyford, Oxon. 8th May, 1928.

NOTES AND QUERIES

Hurricane in Gilbert and Ellice Islands

Capt. E. W. G. Twentyman, of Suva, Fiji, has kindly forwarded an account which he has received from Capt. P. C. Spain of a hurricane which visited Butaritari and Little Makin Islands at the northern end of the Gilbert Islands, in about 3°N, 173°E, on 5th December, 1927.

On 4th December a strong wind blew all the morning from north-east with several heavy squalls. In the afternoon the wind went round to west, but about 5 p.m. the wind again changed to north-east. The sky looked stormy, and the barometer reading (after making an approximate correction for instrumental error) was about 1006.4 mb. At 7 p.m. the wind had shifted to east and by 8.30 p.m. to south-east, and was blowing with increased violence. The barometer was then about 1005.1 mb.

About 1 a.m. on 5th December there was a lull and shortly after 2 a.m. with a roar a terrific wind struck the Government Station. Trees crashed on all sides, and in the Police lines all houses save one were down. All women and children were collected in a hastily erected shelter in the middle of the parade ground, as the safest place from flying nuts and branches. At 4.15 a.m. the barometer was about 1003.7 mb. Daylight presented a dismal scene, many houses being blown down and others damaged, and the road strewn with trees and branches. At 8.30 a.m. the barometer was about 1002.0 mb. and at 9 a.m. 1001.3

mb. The wind was terrific from south-east but fortunately moderated by the time of high tide, and as the tides were neap no great damage was done. By 3 p.m. the wind had considerably moderated but was veering to the west, and by 10 p.m. had fallen away to just an ordinary breeze, while the next morning was almost calm.

The height of the storm was about 8.45 to 9.30 a.m. on the 5th, when the wind velocity was estimated as 80 to 100 miles an hour, but Capt. Twentyman considers that the comparatively slight fall of the barometer does not bear this estimate out. At Little Makin Island the hurricane was accompanied by a violent thunderstorm, but no lives were lost at either island. This is the first hurricane from the south-east that the oldest inhabitants can remember, and owing to the damage to coconut and bread-fruit trees the natives are likely to suffer great hardships.

Hurricanes within five degrees of the equator are rare, and as this example began with the wind from north-east, and the greatest velocity was from south-east, it seems that the centre must have travelled westward south of 3°N. The subsequent change of wind to west may indicate that after passing Butaritari the hurricane recurved to the north-east. It is stated that Butaritari and Little Makin are the only units of the Gilbert Group which have ever been known to suffer from wind storms of a circular nature, or exceeding in velocity the force of a gale.

Birds' Atlantic Flight

Nature of 30th June quotes from *British Birds*, Vol. 22, an instance of bird migration across the Atlantic from east to west.

Two flocks of lapwings arrived in Newfoundland on 20th and 21st December, 1927, and on one of the birds was found a *British Birds* ring which showed it to be a native of Cumberland. It is estimated that the migrating lapwings having their normal speed of some 45 miles an hour aided by a wind of about 55 miles an hour had completed the journey in about 22 hours.

The northern hemisphere charts for 19th and 20th December show high pressure over southern Norway and Iceland, and an elongated area of low pressure along the 50th parallel in the Atlantic. The " gradient wind " was SE or ESE to the west of Iceland, and easterly towards Newfoundland, and the velocity over part of the route nearly 60 miles an hour. Wintry conditions prevailed in both western Ireland and Newfoundland.

The " Table Cloth " on Table Mountain

The photograph which forms the frontispiece of this number of the *Meteorological Magazine* appeared in a Cape Town newspaper during the visit of the British Airship Mission to South Africa last year as described in the last number. The photo-

graph shows an interesting feature of the "table cloth" on table mountain during a "south-easter." The cloud shown is descending over the edge of the mountain and was described in the original publication as resembling a waterfall. Many photographs have been published showing the "table cloth" and two good examples may be found in the *Marine Observer*, Volume I, page 8, 1924, and Volume 2, page 6, 1925, the latter being accompanied by some remarks on the phenomenon. In particular, there is a statement quoted from Findlay's "Sailing Directions for the Indian Ocean," and due to Sir Thomas Maclear, one time Astronomer Royal of the Cape Observatory, to the effect that, "Its north border hangs over the precipice—drapery fashion; but during very strong winds it pours down like a cataract to about 1,000 feet from the top." The photograph reproduced here is of special interest as illustrating this particular feature.

Permission for the reproduction of the photograph has been obtained from Blyth Clayton, Argus Building, Cape Town.

M. A. GIBLETT.

Renewal of the Wick and Muslin of a Wet Bulb Thermometer

In using an ordinary psychrometer it is customary to renew the wick and muslin of the wet bulb about once a month in country districts and more frequently in towns. It seems fairly certain, and is generally understood, that the reading of the wet bulb is affected by the state of cleanliness of the wick and muslin and will thus depend upon the time elapsed since renewing them.

The observations of the present investigation were made during the winter months in a screen on the roof of the Air Ministry (Kingsway), a "town" situation, with the object of estimating the magnitude of the effect. Side by side with the usual two thermometers was mounted a second wet bulb provided with new wick and muslin each day. In the case of the ordinary wet bulb the renewal was made in the first instance every 14 days and later every 21 days. The results are summarised in tabular form, the average depression of the special wet bulb below the ordinary wet bulb together with the number of observations being given to correspond with the number of days elapsed since the wick of the ordinary bulb was changed. The mean depression is also given for periods of seven days. (Readings were adjusted for a discrepancy between the thermometers.)

It is evident that there is a definite increase in the deficiency as the wick of the ordinary wet bulb becomes older; the irregularity during the third week is probably due to the small number of observations.

An error of 0.1° F. in any particular reading may not be of vital importance, but it is very undesirable that a *systematic* error of this order should be introduced. It would therefore appear that, under conditions such as obtained in London a muslin should not be allowed to remain in use more than a fortnight.

It is to be expected that the effect will depend upon the nature of the atmospheric pollution and ordinary dust, smoke, chemical impurities in manufacturing districts and salt sea spray at coastal stations may each affect the reading of the wet bulb differently. Some information is afforded by observations made at Tiree by D. O. Maclean in which a wet bulb was allowed to remain in use without change of muslin for a period of about three months and comparison made with a normal wet bulb with muslin renewed every 21 days. At the end of this period the large difference of 0.6° F. between the two thermometers was recorded. This difference was observed to take place not gradually but in finite stages due to circumstances in which sea spray or excessive dust affected the instrument.

Results similar to these noted here for differently exposed stations would be interesting.

TABLE

Number of days Elapsed																			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Difference: ordinary wet bulb—special bulb (°F.)																				
·01	·00	·04	·06	·04	·05	·07	·05	·10	·07	·07	·07	·10	·13	·14	·14	·17	·09	·12	·10	·10
Number of Observations																				
11	11	11	11	11	11	10	11	11	11	11	11	11	11	7	7	6	7	7	5	6

Mean difference for periods of seven days (°F.)

·04	·08	·12

R. C. SUTCLIFFE.

The Physical-Meteorological Observatory at Davos

Volume 36, no. 5, of the *Journal of State Medicine* contains an account by Dr. F. Lindholm of the work and equipment of the Physical-meteorological Observatory at Davos. The Observatory, of which Dr. Lindholm is now Director, was founded in 1907 by Prof. Dorno, and has recently been incorporated in the Swiss Institute for Alpine Physiology and Tuberculosis Research. The main work of the Observatory is the investigation of solar and sky radiation and the electrical phenomena of the atmosphere.

The methods in use at Davos for determining the intensity of the total radiation received from the sun are described in detail. A special design of Pyrheliograph is used to obtain a continuous record; it consists of a copper cylinder, which is made to rotate by clockwork so that the sun's radiation always falls on a blackened strip situated within the cylinder. A mirror galvanometer is used in conjunction with a thermopile placed behind the blackened strip, a photographic trace being thus obtained. The readings of the Pyrheliograph are checked by a Michelson Actinometer. This consists essentially of a blackened bimetallic strip which suffers a measured deflection when radiation falls upon it. It is not an absolute instrument, the necessary calibration being carried out by means of an Angström Compensated Pyrheliometer. In this instrument there are two blackened strips, one being heated by the sun's radiation and the other by an electric current, which is varied until the temperatures of the two strips, as recorded by two thermocouples, are equal. The energy received from the sun by one strip is then equal to the electrical energy supplied to the other strip.

Ultra-violet radiation investigations form an important part of the work of the Davos Observatory. The instrument used for wave-length determinations is a quartz spectrograph with fairly large dispersion. Interesting results have been obtained concerning the variation of the amount of radiation of the shortest wave-length which pentrates the atmosphere, according to the time of day and season of the year. For quantitative methods, the photo-electric method is largely employed. A cadium element in a uvioglass cell is used for ultra-violet radiation, a glass filter serving to separate the longer wave-lengths from the shorter. For visible radiation a calium cell with a blue filter is used. Recently a new form of photoelectric cell has been developed and perfected at Davos, its chief feature being the employment of a Wulf single thread recorder in conjunction with a calium or cadmium cell. Some results obtained with this instrument are briefly mentioned.

To conclude this account, Dr. Lindholm deals with several other investigations carried out at Davos, including those of local brightness, atmospheric potential gradient and conductivity, atmospheric dust and infra-red radiation.

D. W. JOHNSTON.

Weather and Antiquaries

Referring to the article under the above title which was published in *Meteorological Magazine* for January, Dr. J. P. Williams Freeman has contributed some notes to *Antiquity* for June, 1928. He states that several facts in archæology leave no doubt as to the great lowering in the general level of the

water-table in the chalk from Romano-British times onwards; for example, General Pitt Rivers in excavating the well in the Romano-British village at Woodyates, Dorset, found a Roman bucket at the bottom of it, 60 feet above the level to which modern wells have to be sunk in the immediate neighbourhood. Similarly, the highest springs of our winterbournes, which run only in the wettest seasons, are frequently, perhaps usually, close to the site of some ancient villa or manor often of Saxon or Roman origin. Since we cannot suppose that such sites were chosen for the sake of springs which broke out once in several years, they must at the time have been perennial. Other evidence of the retreat of the ground water is provided by the deep conical pits or spring-ponds, sometimes found at the head of valleys now dry, which have evidently been dug and deepened in an attempt to keep pace with the water as it gradually retreated. It is also pointed out that a number of fifteenth and sixteenth century houses are built on north slopes and face north, in marked contrast to nearly all Roman sites. Contemporary writers praise the north wind and the " gentle east " wind, and decry the violent west wind and the unhealthy south wind. This may point to a warmer climate in these centuries.

In a letter to the *Meteorological Magazine* dated 13th June, Mr. G. M. Meyer has also supplied further evidence that there were geographical changes on the east coast in the thirteenth and fourteenth centuries. In a letter from Sir William Dugdale to Sir Thomas Browne, dated 1658, it is stated that the passage of the Ouse at Wisbech was silted up, and the river diverted to Lynn, in the reign of King Henry III (1216-1272). This silting up may be related to the decrease of rainfall traced by Mr. Meyer in the history of East Kent watermills. In the time of King Edward III (1327-1377) it is stated that the tides in the Humber flowed four feet higher than formerly, which agrees with the belief that the fourteenth century was exceptionally stormy in the North Sea. It was about this time that the port of Ravenser or Ravensburg on the Humber was destroyed by overwhelming inundations of the sea, especially associated with unusually high tides in 1357.

Reviews

Annales de l'Observatoire National d'Athènes. Publiées par Démétrius Eginitis, Directeur de l'Observatoire, Athènes, Imprimerie Gérard Frères. Size 12 × 9¼, Tome VIII, pp. 644, pl. xiii, Tome IX, pp. 614, pl. v, Figs. 21 + 4 charts.

These two volumes contain observations made at meteorological stations in Greece during the years 1915 to 1922, as well as

several memoirs, both meteorological and astronomical. Among these we must specially mention an interesting article in Tome VIII by A. N. Livathinos on cloudiness in Greece. Observations of cloud amount at Athens for the period 1881-1920 are utilised and observations at 35 other stations are available for varying periods mostly for the 20 years, 1900-19. Charts of isonephs for January, April, July, October and for the year are given.

We welcome this evidence of the renewed activity of the Athens Observatory.

Science For You. By J. G. Crowther. Science For You Series. Size 7½ × 5 in., pp. x + 241. London, G. Routledge and Sons Ltd., 1928. 5s. *net.*

This book forms the first volume of a new series of popular scientific books, the "Science for you" series, which is intended to provide short readable essays on recent work in science. The reviewer, who spends a fair proportion of his time in reading scientific papers, confesses that he opened the book with bored toleration, but this soon quickened into interest, which was maintained to the last page.

The author complains in the last chapter that a journalist who writes on scientific subjects must strip away the technical jargon and at the same time retain accuracy. Regarded as scientific journalese, this book fulfils both criteria very well, though the author perhaps stretches a point now and again, as when he describes a fog as a colloid and writes that "the stability of city fogs is deducible from their colloidal nature." One thought eddy motion had something to do with it.

The various chapters range over so wide a field, from the health of miners to super-magnetic fields, that there is not much room for meteorology, but space is found for essays on "Hurricanes" and "Thunderstorms," as well as on "Earthquakes and the earth," and there is a good deal of incidental meteorology in many other chapters, sometimes where one would least expect it, showing that our science has wide contacts with other branches of knowledge.

Books Received

Royal Alfred Observatory, Mauritius. Results of Magnetical and Meteorological Observations for January to June, 1926. Port Louis, 1926.

Rapport de la Réunion de la Commission Internationale de Météorologie Maritime à Zurich, 14-17 Septembre, 1926. K. Ned. Meteor Inst. De Bilt, 1926.

Het Koninklijk Nederlandsch Meteorologisch Instituut A. Organisatie en Inrichting. De Bilt, K. Ned. Meteor. Inst. No. 102. Med. en Verh. 1a. 1927. (French translation.)

Anales de la Sociedad Española Meteorologia. Madrid, July-August, 1927. Vol. I., Núm. 4.

Der jährliche und tägliche Gang des Potentialgefälles in Davos. By F. Lindholm and M. Bider. Reprinted from Met. Zs. 44, 1927, pp. 401-6.

Ein kugelblitzartige Erscheinung. Reprinted from Met. Zs. 44, 1927, p. 391.

Meteorology. Extracts from Statistics of New Zealand for the year 1926. Wellington, 1927.

Sur le role de l'ozone dans l'atmosphère. By J. Lévine. Reprinted from Comptes Rendus, 185, 1927, p. 962.

Jaarboek, Koninklijk Nederlandsch Meteorlogisch Instituut, 1925, A. Meteorologie, B. Aard-Magnetisme (No. 98). Utrecht, 1926.

Ergebnisse Aerologischer Beobachtungen, 1925. K. Ned Meteor. Inst. (No. 160A.) Utrecht, 1926.

Onweders, Optische Verschijnselen, enz. in Nederland. Naar Vrijwillige Waarnemingen in 1923. Deel XLIII. K. Ned. Meteor. Inst. No. 81. Amsterdam, 1926,

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The Weather of June, 1928

Regarded as a whole the weather in the British Isles was generally cool, wet and somewhat cloudy for the time of year but northerly winds were much less general than in May and considerable bright, warm periods were enjoyed at fairly frequent intervals during the month. At the very beginning a ridge of high pressure over Scotland gave brilliant weather in the north on the 1st and, as the anticyclone extended its influence further south, similarly good records of sunshine were obtained in most districts on the 2nd and 3rd. There was a fairly wide range of temperature at this period, ground frost occurring locally in the early morning, especially on the 3rd, when several degrees of frost were registered in London and the reading was as low as 24° F. at Birmingham and 23° F. at Rhayader. During the daytime the thermometer rose slightly above 70° F. in a few places both on the 3rd and 4th.

Meanwhile with the approach of a depression off our south-west coasts conditions began to deteriorate, and subsequently remained generally unsettled throughout the month with heavy rain at times and local thunderstorms. Nearly two inches fell at Harrogate on the 7th, at Roches Point on the 12th and at Brighton on the 13th. On the last-mentioned date 2.12 in. fell

at Caheragh (Co. Cork) and 2.47 in. at Middlesbrough. This day was also outstanding as being one of the warmest during the month in England, temperature rising to about 75° F. or slightly higher in several parts including London. (Other days with a few readings approximately as high were the 22nd and 25th.) On the other hand, in Scotland the 13th was one of the coldest days, temperature remaining below 50° F. throughout the day in some parts. In England the lowest day readings generally were experienced between the 14th and 17th during a period of northerly winds in the rear of the depression which had caused the heavy rain on the 13th. Slight ground frost occurred locally on several mornings and some fairly sharp frost was reported on the 17th.

During the last week the weather became rough and exceptionally wet in some districts, strong winds occurring daily after the 25th, with gales locally on alternate days. The 26th was generally the roughest in the south. On the 28th more than 2.5 in. of rain fell in several parts of Wales and northern England and as much as 4.03 in. at Festiniog in Merioneth and 4.34 in. at Rosthwaite, Borrowdale.

The total rainfall for the month was well above normal in most districts, though in some instances the excess was only small and in others there was even a deficit. In the region where excessive rain fell on the 28th, the total for the month amounted to about 8 in. in several cases and to as much as 10.94in. at Oughtershaw Hall in Yorkshire, 11.31in. at Rosthwaite and 12.26in. at Festiniog.

The sunshine records obtained during the first few days when measurements exceeded 15 hours in many places (Tiree in the Hebrides reported 16.3 hours on the 2nd) were seldom equalled later in the month, though 13 or 14 hours were enjoyed on several occasions and over 15 hours in a few instances. The total duration for the month was much above the average at Stornoway in the Hebrides and there was a small excess in London and some other eastern districts, but in many western districts there was a deficit.

Pressure was above normal over southern France, Italy and Spain and over a belt stretching from Spitsbergen to Iceland, the greatest excess being 5.9 mb. at Isafjord; pressure was below normal elsewhere over western Europe and Scandinavia and also over the Azores and Newfoundland, the greatest deficit being 11.8 mb. at Vardo. Temperature was generally below normal except in Spain and Portugal and northernmost Sweden; in other parts of Sweden the deficit was as much as 5 to 7° F. Rainfall was below normal in Spitsbergen and above normal in Sweden excepting parts of Gothland; in northern Lapland the rainfall was treble the normal.

Violent thunderstorms and heavy rain occurred in Switzerland during the month. On the 1st a thunderstorm did much damage to the crops in eastern Switzerland, several villages in the Canton of Aargau were flooded and the railway line was blocked by landslides near Zuzgen and Zeiningen; in the Canton of Berne lightning struck a group of tourists, killing one and injuring another. Heavy rain occurred again on the 10th and the rivers rose, the Rhine rose about 3 ft. causing damage in the district of Rinkenberg where two persons were drowned. On the evening of the 30th, during a violent thunderstorm, a small bridge on the Interlaken-Grindewald railway was swept away by a sudden torrent; the last train from Interlaken to Zweilütschinen was derailed, its engine falling into the ravine. A sudden storm on the 16th swept the south coast of Algarve in Portugal, and many fishing boats were lost. Hot weather was experienced in Spain during the greater part of the month. Prolonged cold and rain in Latvia is threatening the destruction of the crops, and floods in Zemgale and Livonia have prevented the sowing of spring seed and potatoes.

The monsoon broke in Bombay on the 10th; during the 24 hours ending 8 a.m. on the 13th 10 in. of rain fell, flooding the lower parts of the town; the monsoon was strong in north-east India and Burma but weak elsewhere. Good rains are reported from the Yemen and Aden Protectorate.

A tornado which swept from north-western Kansas into Nebraska did much damage on the 11th to the town of McCook, 100 houses were wrecked and 20 persons injured. On the 18th a tornado swept over Oklahoma and southern Kansas, eight people were killed and about a hundred injured. During the first part of the month the weather was rather rainy and unsettled in the western districts of Canada, temperatures approached the freezing point in one or two places, the last week however was warm and ideal for the growth of the crops which made rapid progress.

The special message from Brazil states that rain was very scarce in the north, the total fall being 2.01in. below normal, in the centre it was 0.70in. below but in the south it was 2.67in. above normal. The circulation was exceptionally active, seven anticyclones passed across the country and there was a continuance of continental depressions. The conditions were unfavourable for crops of sugar cane, tobacco and cereals. At Rio de Janeiro pressure was 2.3mb. below normal and temperature was 3.2° F. above normal.

Rainfall, June 1928—General Distribution

England and Wales ...	145	per cent. of the average 1881-1915.
Scotland	184	
Ireland	196	
British Isles	166	

Rainfall: June, 1928: England and Wales

Co.	Station	In.	Per-cent of Av.	Co.	Station	In.	Per-cent. of Av.
Lond.	Camden Square	2·59	128	*Leics.*	Thornton Reservoir ...	3·52	163
Sur.	Reigate, The Knowle...	2·66	136	,, .	Belvoir Castle.....	3·43	180
Kent.	Tenterden, Ashenden...	2·34	123	*Rut.*	Ridlington	3·36	...
,, .	Folkestone, Boro. San.	2·02	...	*Line.*	Boston, Skirbeck	3·17	174
,, .	Margate, Cliftonville...	2·06	119	,, .	Lincoln, Sessions House	1·46	72
,, .	Sevenoaks, Speldhurst	3·07	...	,, .	Skegness, Marine Gdns	2·35	...
Sus.	Patching Farm	2·39	118	,, .	Louth, Westgate	1·84	85
,, .	Brighton, Old Steyne	2·83	157	,, .	Brigg, Wrawby St. ...	2·67	...
,, .	Tottingworth Park ...	4·06	193	*Notts.*	Worksop, Hodsock ...	2·15	109
Hants.	Ventnor, Roy. Nat. Hos.	2·37	130	*Derby.*	Derby	2·76	123
,, .	Fordingbridge, Oaklnds	2·53	137	,, .	Buxton, Devon Hos....	4·93	153
,, .	Ovington Rectory	2·64	114	*Ches.*	Runcorn, Western Pt.	4·95	192
,, .	Sherborne St. John ...	2·22	104	,, .	Nantwich, Dorfold Hall	4·74	...
Berks.	Wellington College ...	2·03	94	*Lancs.*	Manchester, Whit. Pk.	5·32	202
,, .	Newbury, Greenham...	2·55	118	,, .	Stonyhurst College ...	7·47	243
Herts.	Benington House	1·96	95	,, .	Southport, Hesketh Pk	4·86	224
Bucks.	High Wycombe	3·08	159	,, .	Lancaster, Strathspey	7·00	...
Oxf. .	Oxford, Mag. College	1·63	77	*Yorks.*	Wath-upon-Dearne ...	3·00	135
Nor.	Pitsford, Sedgebrook...	2·51	130	,, .	Bradford, Lister Pk....	6·04	257
,, .	Oundle	2·14	...	,, .	Oughtershaw Hall.....	10·94	...
Beds.	Woburn, Crawley Mill	2·39	...	,, .	Wetherby, Ribston H.	4·40	209
Cam.	Cambridge, Bot. Gdns.	...	...	,, .	Hull, Pearson Park ...	2·33	113
Essex.	Chelmsford, County Lab	2·32	122	,, .	Holme-on-Spalding ...	3·93	...
,, .	Lexden, Hill House ...	2·40	...	,, .	West Witton, Ivy Ho.	5·42	...
Suff.	Hawkedon Rectory ...	2·28	110	,, .	Felixkirk, Mt. St. John	4·06	185
,, .	Haughley House	1·51	...	,, .	Pickering, Hungate ...	3·94	...
Norf.	Beccles, Geldeston	...	...	,, .	Scarborough	3·52	191
,, .	Norwich, Eaton..... ...	2·30	119	,, .	Middlesbrough	5·14	272
,, .	Blakeney.....	2·20	118	,, .	Baldersdale, Hury Res.	4·96	...
,, .	Little Dunham	3·38	151	*Durh.*	Ushaw College	5·10	236
Wilts.	Devizes, Highclere.....	2·48	110	*Nor.*	Newcastle, Town Moor	4·01	185
,, .	Bishops Cannings	2·99	124	,, .	Bellingham, Highgreen	5·24	...
Dor.	Evershot, Melbury Ho.	3·63	159	,, .	Lilburn Tower Gdns....	5·94	...
,, .	Creech Grange	2·21	...	*Cumb.*	Geltsdale.....	5·56	...
,, .	Shaftesbury, Abbey Ho.	2·48	107	,, .	Carlisle, Scaleby Hall	4·93	196
Devon.	Plymouth, The Hoe ..	2·27	105	,, .	Borrowdale, Rosthwaite	11·31	...
,, .	Polapit Tamar	1·79	83	,, .	Keswick, High Hill ...	6·64	...
,, .	Ashburton, Druid Ho.	2·93	114	*Glam.*	Cardiff, Ely P. Stn. ...	2·45	98
,, .	Cullompton.....	2·66	125	,, .	Treherbert. Tynywaun	8·22	...
,, .	Sidmouth, Sidmount...	1·84	88	*Carm.*	Carmarthen Friary ...	6·08	212
,, .	Filleigh, Castle Hill ...	3·21	...	,, .	Llanwrda, Dolaucothy	7·77	226
,, .	Barnstaple N. Dev. Ath.	3·07	137	*Pemb.*	Haverfordwest, School	5·04	187
Corn.	Redruth, Trewirgie ...	2·61	105	*Card.*	Aberystwyth	5·62	...
,, .	Penzance, Morrab Gdn.	2·23	10	,, .	Cardigan, County Sch.	4·26	...
,, .	St. Austell, Trevarna...	2·27	87	*Brec.*	Crickhowell, Talymaes	4·20	...
Soms.	Chewton Mendip	2·71	92	*Rad.*	Birm W. W. Tyrmynydd	6·23	190
,, .	Long Ashton	2·87	...	*Mont.*	Lake Vyrnwy.....	6·36	201
,, .	Street, Hind Hayes ...	3·23	...	*Denb.*	Llangynhafal	4·11	...
Glos.	Cirencester, Gwynfa ...	3·35	140	*Mer.*	Dolgelly, Bryntirion...	7·91	228
Here.	Ross, Birchlea.....	2·11	97	*Carn.*	Llandudno	3·93	194
,, .	Ledbury, Underdown	2·48	110	,, .	Snowdon, L. Llydaw 9	20·68	...
Salop.	Church Stretton.....	3·59	148	*Ang.*	Holyhead, Salt Island	4·06	189
,, .	Shifnal, Hatton Grange	3·35	150	,, .	Lligwy.....	6·20	...
Worc.	Ombersley, Holt Lock	2·50	111	*Isle of Man*			
,, .	Blockley, Upton Wold	2·84	107		Douglas, Boro' Cem....	6·44	...
War.	Farnborough	2·47	104	*Guernsey*			
,, .	Birmingham, Edgbaston	3·00	129		St. Peter P't. Grange Rd.	3·03	164

Rainfall: June, 1928: Scotland and Ireland

Co.	Station	In.	Per-cent of Av.	Co.	Station	In.	Per-cent of Av.
Wigt .	Stoneykirk, Ardwell Ho	5·47	225	*Suth* .	Loch More, Achfary ...	5·47	148
,, .	Pt. William, Monreith	5·31	...	*Caith* .	Wick	3·19	177
Kirk .	Carsphairn, Shiel.	9·66	...	*Ork* .	Pomona, Deerness	1·90	103
,, .	Dumfries, Cargen	7·36	...	*Shet* .	Lerwick	3·69	207
Dumf .	Eskdalemuir Obs.	7·87	250	*Cork* .	Caheragh Rectory	8·18	...
Roxb .	Branxholm	5·40	240	,, .	Dunmanway Rectory...	7·57	216
Selk .	Ettrick Manse	7·57	...	,, .	Ballinacurra	5·24	201
Peeb .	West Linton	4·88	...	,, .	Glanmire, Lota Lo. ...	5·65	209
Berk .	Marchmont House.....	5·39	229	*Kerry* .	Valentia Obsy.	5·84	183
Hadd .	North Berwick Res.	4·35	262	,, .	Gearahameen	11·80	...
Midl .	Edinburgh, Roy. Obs.	5·18	280	,, .	Killarney Asylum	...	...
Ayr .	Kilmarnock, Agric. C.	4·24	193	,, .	Darrynane Abbey	6·22	198
,, .	Girvan, Pinmore	4·38	152	*Wat* .	Waterford, Brook Lo...	6·34	236
Renf .	Glasgow, Queen's Pk. .	4·66	202	*Tip* .	Nenagh, Cas. Lough...	4·33	177
,, .	Greenock, Prospect H.	7·01	212	,, .	Roscrea, Timoney Park	4·72	...
Bute .	Rothesay, Ardencraig .	6·19	202	,, .	Cashel, Ballinamona...	3·68	160
,, .	Dougarie Lodge	4·26	...	*Lim* .	Foynes, Coolnanes.....	4·27	166
Arg .	Ardgour House	7·46	...	,, .	Castleconnel Rec.	5·26	...
,, .	Manse of Glenorchy	6·27	...	*Clare* .	Inagh, Mount Callan...	5·40	...
,, .	Oban	5·17	...	,, .	Broadford, Hurdlest'n.	4·52	...
,, .	Poltalloch	4·33	142	*Wexf* .	Newtownbarry	6·26	...
,, .	Inveraray Castle...	7·14	180	,, .	Gorey, Courtown Ho ..	5·57	229
,, .	Islay, Eallabus	4·46	178	*Kilk* .	Kilkenny Castle.....	3·89	160
,, .	Mull, Benmore	...	...	*Wic* .	Rathnew, Clonmannon	5·09	...
,, .	Tiree	2·58	...	*Carl* .	Hacketstown Rectory..	5·57	199
Kinr .	Loch Leven Sluice.....	4·96	226	*QCo* .	Blandsfort House	3·98	154
Perth .	Loch Dhu	7·50	180	,, .	Mountmellick.....	5·47	...
,, .	Balquhidder, Stronvar	5·06	...	*KCo* .	Birr Castle	4·35	188
,, .	Crieff, Strathearn Hyd.	4·46	169	*Dubl* .	Dublin, FitzWm. Sq...	4·79	246
,, .	Blair Castle Gardens ...	2·75	139	,, .	Balbriggan, Ardgillan.	4·42	220
Forf .	Kettins School	3·09	165	*Me'th* .	Beaupare, St. Cloud...	5·02	...
,, .	Dundee, E. Necropolis	4·08	227	,, .	Kells, Headfort	5·50	208
,, .	Pearsie House.....	2·65	...	*W.M* .	Moate, Coolatore	5·75	...
,, .	Montrose, Sunnyside...	2·98	...	,, .	Mullingar, Belvedere..	6·15	236
Aber .	Braemar, Bank	2·96	151	*Long* .	Castle Forbes Gdns.....	6·85	266
,, .	Logie Coldstone Sch....	2·60	133	*Gal* .	Ballynahinch Castle ...	8·69	245
,, .	Aberdeen, King's Coll.	3·28	192	,, .	Galway, Grammar Sch.	5·04	...
,, .	Fyvie Castle	3·32	...	*Mayo* .	Mallaranny.....	7·07	...
Mor .	Gordon Castle	3·57	175	,, .	Westport House.....	5·53	205
,, .	Grantown-on-Spey ...	2·98	132	,, .	Delphi Lodge.....	11·73	...
Na .	Nairn, Delnies	2·90	165	*Sligo* .	Markree Obsy.....	6·90	229
Inv .	Ben Alder Lodge	...	...	*Cav'n* .	Belturbet, Cloverhill...	4·59	188
,, .	Kingussie, The Birches	2·82	...	*Ferm* .	Enniskillen, Portora...	7·34	...
,, .	Loch Quoich, Loan ...	10·10	...	*Arm* .	Armagh Obsy.....	4·18	166
,, .	Glenquoich	8·35	170	*Down* .	Fofanny Reservoir.....	7·21	...
,, .	Inverness, Culduthel R.	3·42	...	,, .	Seaforde	4·39	159
,, .	Arisaig, Faire-na-Squir	3·56	...	,, .	Donaghadee, C. Stn ...	3·79	163
,, .	Fort William	...	...	,, .	Banbridge, Milltown...	3·00	117
,, .	Skye, Dunvegan	4·98	...	*Antr* .	Belfast, Cavehill Rd ...	4·81	...
R & C.	Alness, Ardross Cas. ...	3·29	146	,, .	Glenarm Castle	9·45	...
,, .	Ullapool	3·45	...	,, .	Ballymena, Harryville	5·57	191
,, .	Torridon, Bendamph...	5·58	137	*Lon* .	Londonderry, Creggan	6·09	216
,, .	Achnashellach	6·01	...	*Tyr* .	Donaghmore	6·21	...
,, .	Stornoway	3·30	142	,, .	Omagh, Edenfel.....	5·78	205
Suth .	Lairg	2·70	...	*Don* .	Malin Head.....	4·47	209
,, .	Tongue	3·56	174	,, .	Dunfanaghy	3·66	...
,, .	Melvich	4·27	220	,, .	Killybegs, Rockmount.	4·92	129

Climatological Table for the British Empire, January, 1928.

STATIONS	PRESSURE		TEMPERATURE						Relative Humidity.	Mean Cloud Am'nt	PRECIPITATION			BRIGHT SUNSHINE	
	Mean of Day M.S.L.	Diff. from Normal	Absolute		Mean Values			Mean Wet Bulb			Am'nt	Diff. from Normal	Days	Hours per day	Percentage of possible
			Max.	Min.	Max.	Min.	½ max. and min.	Diff. from Normal							
	mb.	mb.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	%	0—10	in.	in.			
London, Kew Obsy: ..	1010·0	− 7·6	53	26	45·9	36·0	40·9	+ 2·0	37·8	89	6·1	1·91	+ 0·15	19	1·7	17
Gibraltar	1024·0	+ 2·8	67	42	60·4	48·3	54·3	− 0·5	47·6	77	2·4	0·36	− 4·70	7	..	..
Malta	1017·1	− 0·5	65	50	58·7	52·8	55·7	+ 0·4	52·5	83	7·5	6·83	+ 3·62	20	4·9	49
St. Helena	1011·7	+ 1·9	71	57	68·3	59·2	63·7	− 0·8	60·7	93	9·1	1·80	− 1·17	17	..	..
Sierra Leone	1011·0	+ 0·2	92	67	87·8	72·4	80·1	− 1·2	72·9	70	3·1	2·06	+ 1·65	3	..	..
Lagos, Nigeria	1008·2	− 1·7	91	71	88·3	75·6	81·9	+ 1·0	75·8	83	6·7	1·77	+ 0·70	7	..	..
Kaduna, Nigeria	1015·0	+ 3·4	93	67	90·2	69·8	80·0	+ 6·6	72·6	90	1·6	0·05	+ 0·05	2	..	..
Zomba, Nyasaland	1008·5	+ 1·1	91	62	82·9	65·1	74·0	+ 1·2	..	79	7·0	9·49	− 1·61	22	..	..
Salisbury, Rhodesia	1008·4	− 0·1	85	54	79·6	61·9	70·7	+ 1·0	64·5	73	7·5	7·34	− 0·13	21	6·5	50
Cape Town	1014·6	+ 1·2	90	54	79·6	62·3	70·9	+ 1·0	64·2	72	3·2	0·54	− 0·16	6	..	..
Johannesburg	1010·1	0·0	84	49	77·6	58·0	67·8	+ 1.3	59·7	74	5·4	5·90	− 0·27	15	7·2	53
Mauritius	1013·1	+ 1·2	92	70	86·7	73·2	80·0	+ 0·7	75·6	71	6·0	3·83	− 3·93	19	9·5	72
Bloemfontein	..	..	92	49	84·1	60·3	72·2	− 1·0	62·5	66	4·0	4·15	+ 0·13	13	..	..
Calcutta, Alipore Obsy.	1016·0	+ 0·8	89	49	79·4	57·8	68·6	+ 2·2	57·7	82	2·5	0·17	− 0·17	1*	..	..
Bombay	1013·3	− 0·3	87	65	83·6	69·4	76·5	+ 1·2	65·3	72	1·4	0·00	− 0·10	0*	..	..
Madras	1013·9	− 0·2	93	69	88·6	72·9	80·7	+ 4·6	70·2	74	5·8	0·03	− 1·36	0*	..	..
Colombo, Ceylon	1011·4	− 0·1	89	67	86·3	72·4	79·3	+ 0·2	74·9	75	5·2	6·27	+ 2·77	15	8·0	68
Hongkong	1019·1	− 0·7	77	45	65·9	57·8	61·9	+ 1·7	58·5	82	8·0	1·88	+ 0·51	9	3·0	28
Sandakan	..	..	89	73	87·6	81·5	84·5	+ 4·7	77·5	85	..	26·61	+ 8·16	22	..	..
Sydney	1013·8	+ 1·3	101	60	78·5	64·7	71·6	− 0·1	66·1	66	5·2	2·58	− 1·15	14	8·3	59
Melbourne	1014·5	+ 1·6	104	49	77·6	58·3	67·9	+ 0·4	60·5	60	5·5	4·04	+ 2·19	12	6·7	47
Adelaide	1014·5	+ 1·5	109	51	82·8	61·4	72·1	− 1·8	58·8	38	5·0	1·01	+ 0·28	5	9·4	67
Perth, W. Australia	1013·6	+ 1·1	100	52	85·1	62·6	73·9	0·0	63·1	50	4·3	0·85	+ 0·51	5	9·7	70
Coolgardie	1013·1	+ 1·7	109	49	88·2	59·5	73·9	− 3·5	59·2	40	2·9	0·21	− 0·26	6	..	..
Brisbane	1013·4	+ 2·1	92	62	83·8	67·9	75·9	− 1·3	70·0	68	6·3	6·15	− 0·12	19	8·3	61
Hobart, Tasmania	1014·2	+ 3·9	101	47	72·6	54·2	63·4	+ 1·1	56·8	60	6·5	4·42	+ 2·63	14	7·4	50
Wellington, N.Z.	1022·8	+ 9·5	78	45	68·2	53·4	60·8	− 1·7	57·7	73	5·5	0·19	− 3·14	5	10·1	69
Suva, Fiji	1007·2	− 0·5	94	72	87·1	76·1	81·6	+ 1·7	76·4	77	6·5	9·65	− 1·07	24	6·5	50
Apia, Samoa	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Kingston, Jamaica	1015·8	+ 0·7	89	64	85·0	67·4	76·2	− 0·6	64·9	83	2·7	0·16	− 0·80	1	6·4	57
Grenada, W.I.	1009·6	− 3·0	88	70	83·9	73·1	78·5	+ 1·5	72·7	79	4·6	4·12	− 0·31	25	..	..
Toronto	1013·8	− 3·6	44	1	30·9	19·5	25·2	+ 3·1	21·6	76	4·8	2.30	− 0·57	14	2·6	28
Winnipeg	1016·9	− 2·9	41	−25	15·7	1·3	8·5	+12·9	..	..	4·4	0·39	− 0·43	6	3·4	40
St. John, N.B.	1011·0	− 4·7	48	−10	28·8	10·9	19·9	+ 0·7	17·4	67	7·0	4·98	+ 0·18	14	3·6	40
Victoria, B.C.	1021·1	+ 5·8	51	24	44·7	38·9	41·8	+ 1·7	39·9	90	8·6	6·12	+ 1·61	17	1·7	20

* For Indian stations a rain day is a day on which 0·1 in. or more rain has fallen.

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